Committee on Resources

Witness Testimony

Testimony on Resident Exotic Plants and Pests Threatening the Health of the National Forests
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Forest Health: Impact of Invading Pathogens

Centuries of human influence, both pre- and post-European settlement, have shaped our North American forest ecosystems. Fire, grazing, logging, fire control and wildlife management all have significantly altered our forests. With the exception of intensively managed or artificially regenerated stands, the forests that exist today represent what has grown following the impacts of human activities. They certainly do not reflect the concept of the primeval forest that often is described as diverse, complex and species rich.

One of the most significant influences on forest dynamics and health has been caused by the introduction of exotic pests. With technological and sociological changes, humans and their material goods have moved intercontinentally with ever increasing efficiency and frequency. This movement has perpetuated a dramatic increase in biological invasions by transporting organisms past natural geographic barriers that previously limited their dispersal. The cumulative number of exotic pest species that have been introduced continues to mount each year.

Fortunately, most exotic invaders are not successful; those that are have had devastating consequences. The success of invading organisms is generally viewed as a three-step process that includes their arrival, establishment, and spread.

- **Arrival** . Humans have accelerated the ebb and flow of species in two ways. We have augmented natural movement by accidental transportation of species and by intentional introductions (particularly non-native plants). In some cases, plant introductions have carried a compliment of insects and pathogens. Unfortunately, the gravity of intercontinental movement was not appreciated until the early 1900's. Federal and State plant quarantine regulations followed.
- **Establishment** . This term is defined as the process that results in a population of organisms that

persists for many generations. Founder populations are typically small and consequently at risk of extinction. Initial population size is often important. Successful establishment of pathogens is highly dependent on the availability of host plants as well as suitable environmental conditions.

- **Spread** . Once a population is established, its density will increase and expand into adjacent areas if suitable habitat (host plants) and appropriate environmental conditions exist. For most biological invasions, this spread is the only process that we are able to observe directly, since the arrival and establishment phases usually occur without notice by humans.

A general principle of plant pathology is: a population of plants that has co-evolved with a killing pathogen has resistance to that pathogenic organism. Conversely, a plant may be highly susceptible to a foreign pathogen that it has never encountered. Because of extreme host susceptibility, introduced foreign pathogens have created severe problems world-wide. Briefly described below are four exotic pathogens, which once introduced to North America, became established and spread among extremely susceptible forest tree populations, dramatically changing the ecosystems they invaded.

- **Chestnut Blight** . The most devastating pathogen introduction recorded in the past two centuries was Cryphonectria parasitica, the causal organism of chestnut blight. A native of the Orient, this fungus was introduced before the turn of the century. Undoubtedly, it took almost a decade to spread adequately before it was identified and described. The fungus eliminated the American chestnut (Castanea dentata) as a mature tree from our eastern forests. The impact of losing a species that composed up to 25% of the Appalachian forests was unparalleled economically, sociologically and ecologically. Research repeatedly shows that the loss of the chestnut continues to impact our eastern forests as many of the species that replaced chestnut are not as well suited to the ecological niche that chestnut once filled.
- **Beech Bark Disease** . The combination of an introduced scale insect (Cryptococcus fagisuga) and an introduced canker fungus (Nectria coccinea var. faginata) has resulted in the devastation of American beech (Fagus grandifolia) from the Canadian Maritimes to central Pennsylvania. New outbreaks of this scale insect-fungal interaction recently have been discovered in North Carolina, Ohio, Virginia and West Virginia, well in advance of the central Pennsylvania killing front. Once infected, most mature beech trees die but their root systems continue to produce multiple sprouts that not only become infected but also disrupt the beech forest ecosystem by their abundance.
- **White Pine Blister Rust** . This disease is caused by a fungus (Cronartium ribicola) that survives only on living hosts. Discovered in the early 1900's in the eastern U.S., the fungus undoubtedly was transported to the U.S. on white pine nursery stock imported from Europe. The fungus is considered the most important disease agent of North American (5-needle) white pine species. Multiple introductions undoubtedly occurred, including its early 1920's discovery in western North America. This pathogen has created major ecological impacts on coniferous forests, especially in the West where over 95% of the original stands of western white (Pinus monticola) and sugar pine (Pinus lambertiana) have been killed.
- **Dutch Elm Disease** The tree disease of exotic origin best known to most Americans is Dutch elm disease, caused by the vascular fungus, Ophiostoma ulmi. This organism has nearly eliminated American and slippery elms in many urban areas and riparian waterways. Its devastation continues. Only the fact that elms set many seed at a relatively early age has allowed it to remain a common but greatly altered species in the ecosystems it inhabits.

Unfortunately, there are few management or control options for bringing these organisms into balance with the ecosystems they have invaded. The few opportunities that exist for their regulation involve emerging

biological control technologies and the enhancement of natural host plant resistance.

Conclusions and Recommendations

Introduced forest pests represent a major environmental problem that is likely to escalate in the future. The rate of invasions by exotic pests has been accelerating over the past 200 years (Figure 1) and this increase will likely continue. The ecological and economic impacts of invasions to our forests are comparable to numerous other important environmental problems. What can we do to curb these problems?

- Although measures are in place to prevent the transportation of exotic pests, relatively little additional effort in this area could substantially reduce the frequency of forest pest invasions. This should include assessment of potential risk of exotic pests by all countries. Such investigations may entail conducting research on forest pests in the country of origin.
- Special attention should be focused on introduced plant species. Historically, introductions of exotic plants were the result of ill-conceived actions. Such introductions should be scrutinized to the same extent that occurs with the release of biological control agents from other continents. Additionally, introduced plant species have served as hosts for exotic pests.
- The probability of pest arrival and establishment could be greatly reduced if greater effort went into detection and intensively searching for new pest populations among species known to be at high risk to foreign pathogens.
- Promoting self sufficiency in wood products would dramatically reduce the importation of both raw and processed wood products, thus reducing the probability of pest introductions.

SUMMARY

Forest Health: Impact of Invading Pathogens

A variety of human influences over centuries have shaped our current forest ecosystems. Some of the most significant insults have resulted from the introductions of exotic pests, including forest pathogens. This report summarizes the steps of arrival, establishment and spread that are required for exotic organisms to successfully become established. Four pathogens that have had devastating consequences on the trees of North America also are briefly described. The diseases they incite are, chestnut blight, beech bark disease, white pine blister rust and Dutch elm disease. Each of these diseases have greatly altered the forest ecosystems where they have occurred and have left few alternatives for their management or control. A series of recommendations to prevent future catastrophes include redoubling efforts to inspect introduced plant materials, the development of risk assessment programs in counties where potentially damaging forest pests exist, tightening regulations on introducing foreign plant material or plant products and promoting greater U.S. self sufficiency in wood products to reduce importations.